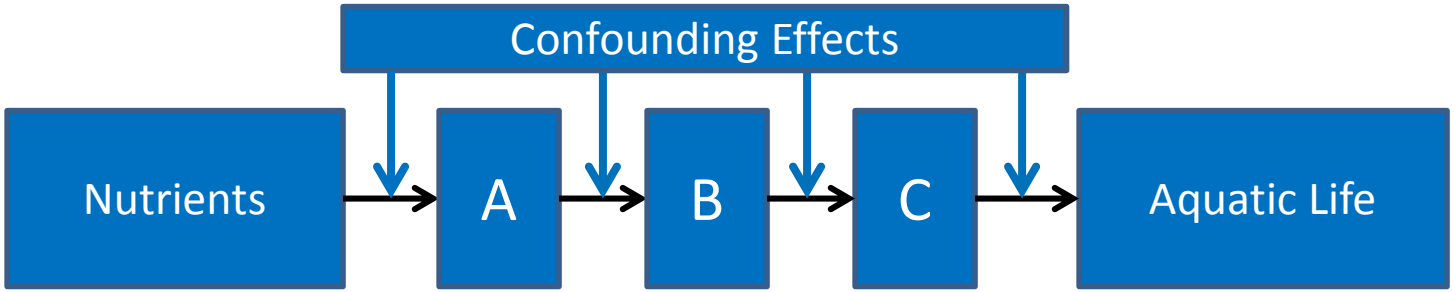
EPA
United States
Environmental Protection
Agency

# Combined Numeric Nutrient Criteria

Goal: Present an optional approach to nutrient criteria development that combines multiple nutrient-related thresholds into a single criterion

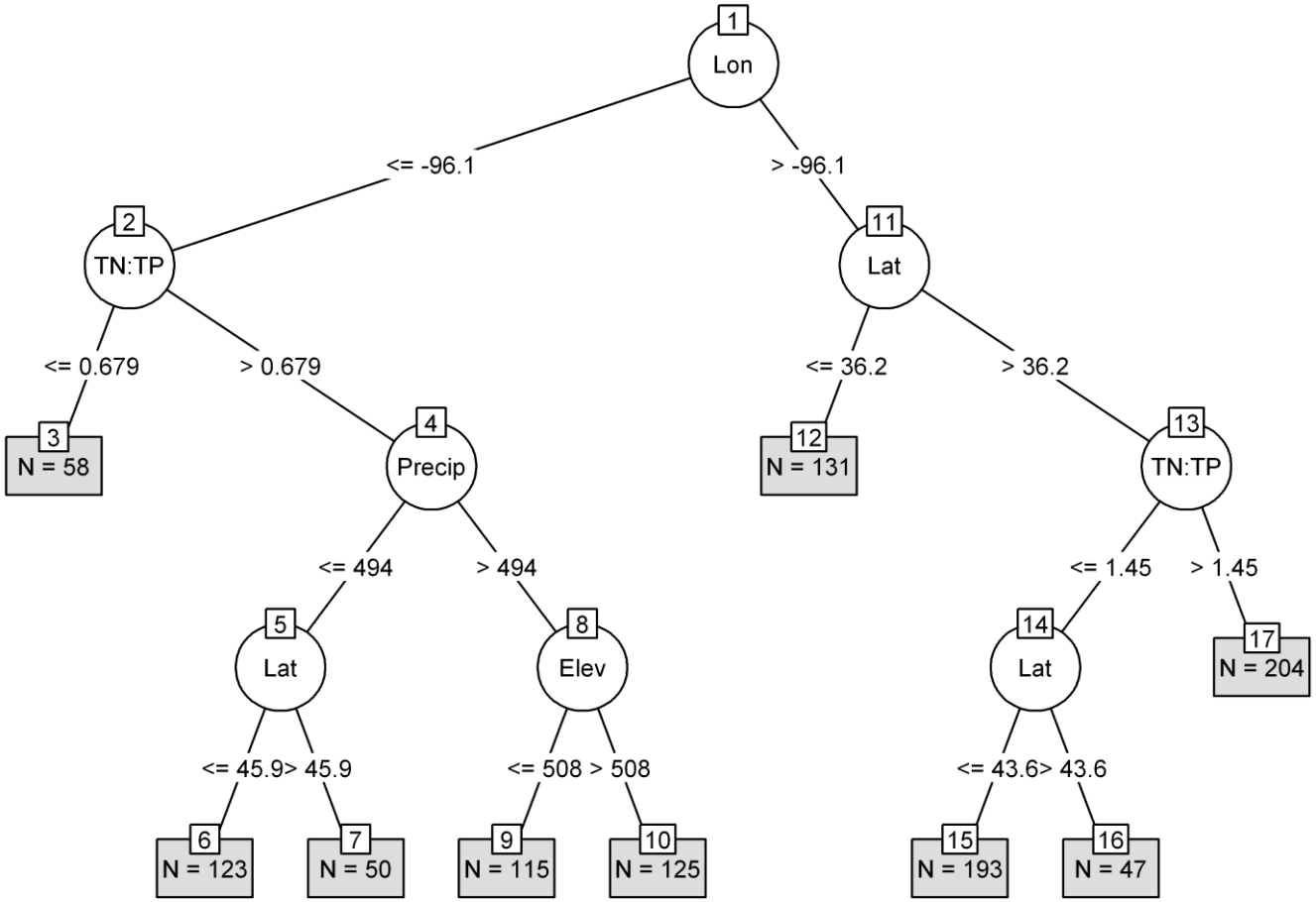
# Outline

- Introduce the concept of combined criteria
- Present EPA's current Guiding Principles
- Provide illustrative examples

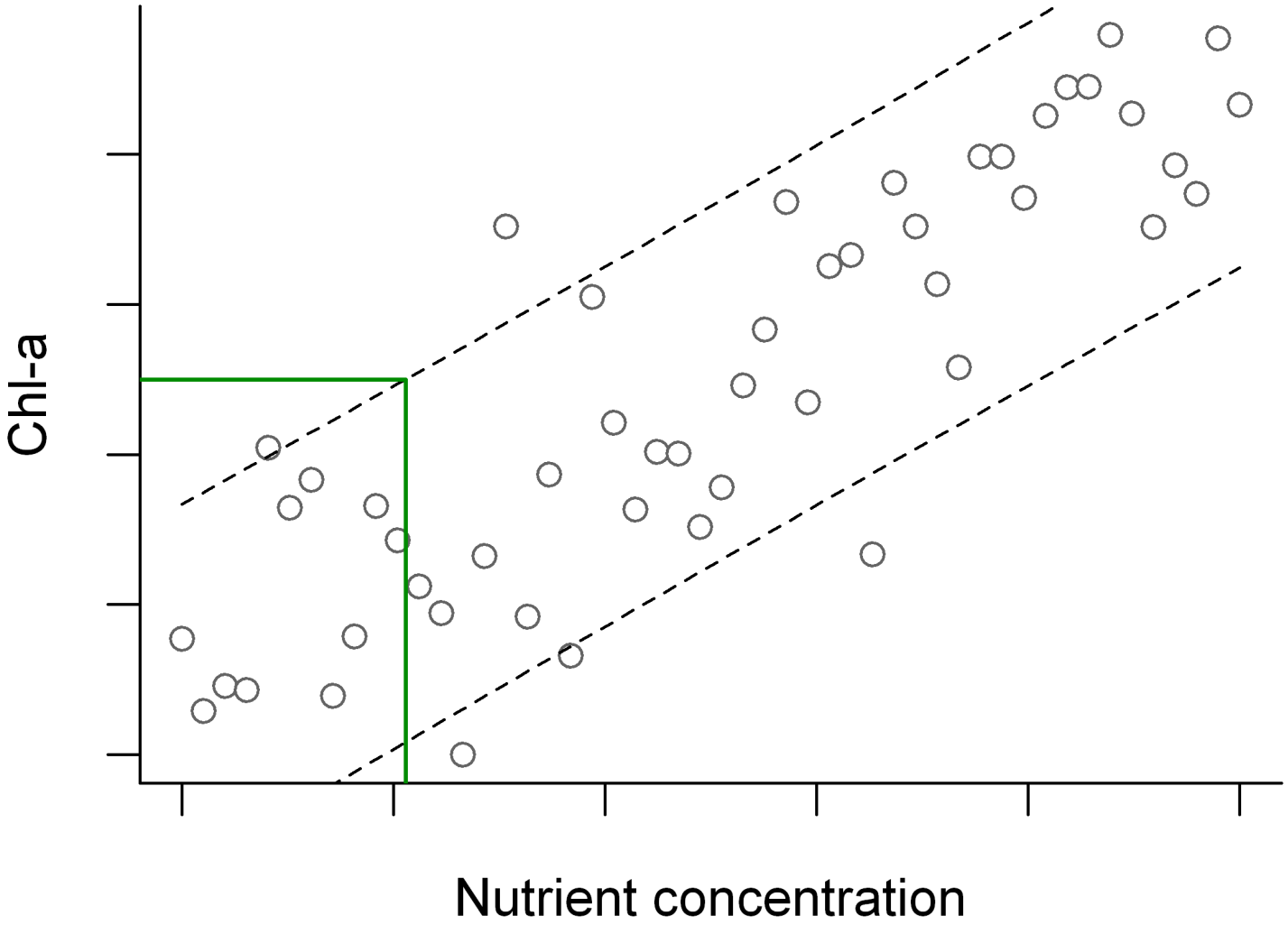

Confounding Effects
Nutrients
A
B
C
Aquatic Life

# Approaches for Addressing Variability in Relationships

- Classification



# Deriving a Protective Criterion



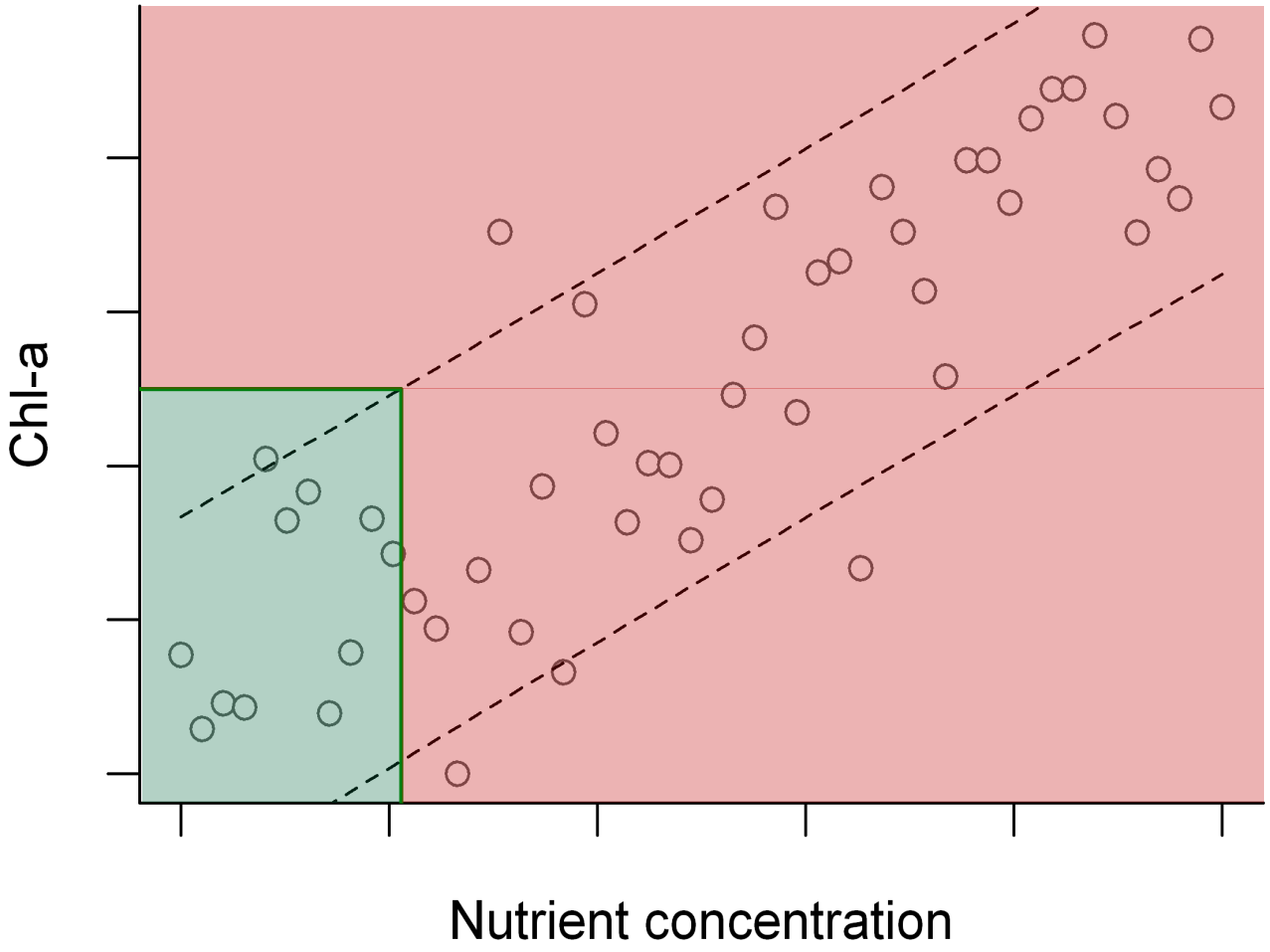
# Independent Application

All criteria have traditionally been applied independently.

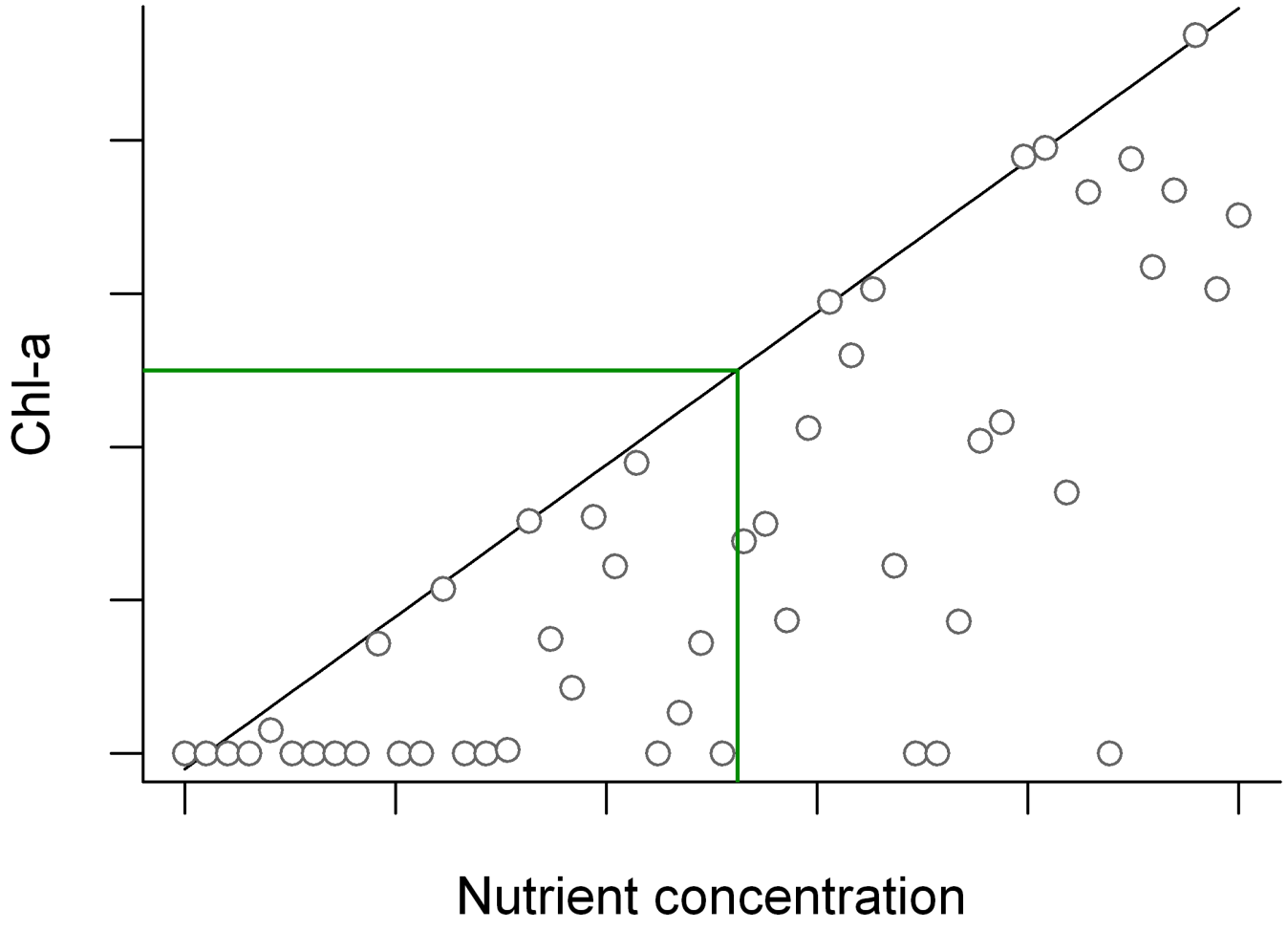
- Waterbodies are subject to multiple nutrient criteria.
- Exceeding any one water quality standard means that a waterbody must be listed as “impaired.”

| | Nutrients ≤ | Nutrients > |
|---|---|---|
| **Chlorophyll-a ≤** | Not impaired | Impaired |
| **Chlorophyll-a >** | Impaired | Impaired |

# Independent Application: A Graphical Depiction



# A Less Idealized Example



# Combined Criteria

- Combines multiple nutrient-related thresholds into a single assessment decision (e.g., total nitrogen/phosphorus, chlorophyll-a), which increases assessment accuracy.
  - Exceedance of a suite of causes and responses might be more reliably associated with a high risk of losing a designated use.
- Main considerations:
  - Must protect applicable uses
  - Must be scientifically defensible

# Engagement With States

October 2011 – the EPA/state co-regulator workshop was held to discuss novel approaches to criteria development in order to meet the following criteria goals:

- Meet states' assessment and listing goals
- Protect designated uses and downstream waters
- Remain scientifically defensible

# Current Science

April 2013 – the EPA expert workshop on *Nutrient Indicators in Streams* had a goal to gain scientific insight to identify the following:

- Nutrient pollution indicators that are both sensitive to nutrient stress and predictive of impacts to higher trophic levels
- Combined criteria approaches that protect aquatic life in streams

# Current Science

April 2013 – the EPA expert workshop, *Nutrient Indicators in Streams* identified the following indicators that are most sensitive and predictive:

- Total nitrogen and phosphorus concentrations
- Algal biomass and algal assemblage
- Dissolved oxygen and pH

# Current Science

April 2013 – the EPA expert workshop on *Nutrient Indicators in Streams* identified a range approach as one scientifically defensible approach. A range approach:

- Establishes upper and lower nutrient levels indicating non-attainment and attainment
- Applies a decision framework of response information within the range of nutrient concentrations

# Current Science

April 2013 – the EPA expert workshop on *Nutrient Indicators in Streams* identified the following:

- Any adverse response should be sufficient to indicate non-attainment.
- Proper classification is fundamental to reducing variability in nutrient responses.
- Sufficient data is important for criteria development and assessment.

# Guiding Principles

September 2013 – the Guiding Principles were released to provide a framework for states currently pursuing or considering a combined approach for developing and implementing numeric nutrient criteria that:

- Protect the designated use
  - Exceedance of criteria triggers action prior to actual impairment of the designated use
- Protect downstream waters
  - Ensures attainment and maintenance of water quality standards downstream
- Include numeric nutrient targets
  - Facilitates permitting and total maximum daily loads
- Are scientifically defensible

# Guiding Principles

- The Guiding Principles contain the following parameters that are sensitive to nutrient stress and predictive of impacts to designated uses:
  - Total nitrogen and phosphorus measures
  - Algal component, including primary production and algal assemblage measures
  - Ecosystem function component
- States are encouraged to include additional endpoints where appropriate.
  - Higher trophic level endpoints should not be the predominant or sole components.

# Guiding Principles

- Demonstrate criteria component sensitivity to nutrient pollution and a linkage to designated uses.
- Define the desired ambient condition and level of protection for the waterbody.
- Express the criterion in a way that integrates causal and response parameters and allows for a transparent and reproducible assessment decision.

# Expressing a Protective Combined Criterion: Examples

- Simple matrix
- Range approach

# Simple Matrix

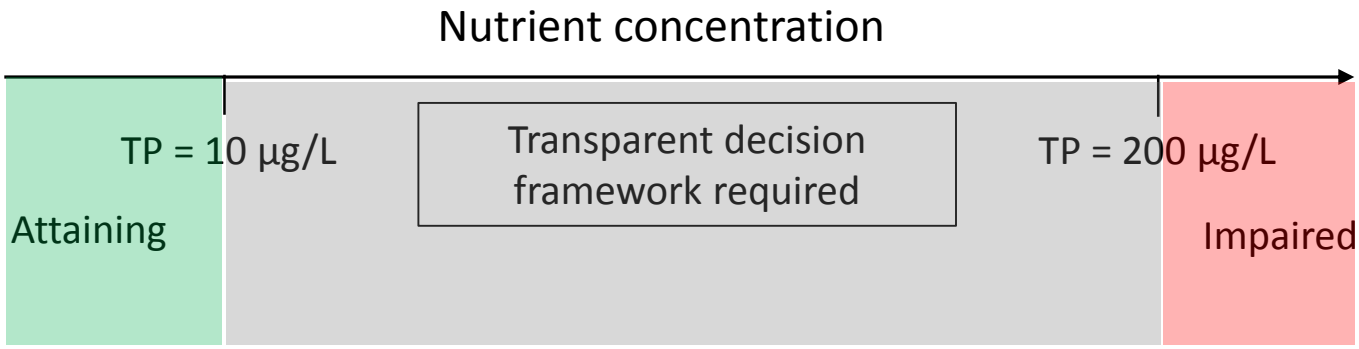
Considers a water "impaired" if causal AND any response parameter are exceeded.

| | Nutrients ≤ | Nutrients > |
|---|---|---|
| All response ≤ | Not impaired | Not impaired* |
| Any response > | Impaired (cause not determined) | Impaired |

*Site might be candidate for site-specific criteria.

# Range Approach

If causal parameters are within range, response parameters are required to assess attainment.




| | Nutrients < lower range | Nutrients in range | Nutrients > upper range |
|---|---|---|---|
| All response ≤ | Not impaired for nutrients | Not impaired for nutrients | Impaired for nutrients |
| Any response > | Not impaired for nutrients* | Impaired for nutrients | Impaired for nutrients |

*Site impaired for biological response condition, cause unknown.

# Lessons Learned

- Combined criteria provide states with flexibility within the context of quantifiable variability.
  - Combining causal and response variables requires knowing both well and having numeric thresholds for both.
  - Focus on a set of sensitive responses (e.g., algal assemblage, primary productivity).
  - Criteria must protect applicable uses.
- Focus on clear decision frameworks that are transparent and reproducible.